USER MANUAL

Electrical Part-turn Valve Actuators

ELTORQUE

LIFELONG INTELLIGENT CONTROL

QT 250 2.2/ 2.3 EX QT 800 2.2/2.3 EX

Revision Date: 18.08.2014

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1 INTRODUCTION

Eltorque is a model range of electric valve actuators suitable for use in a wide variety of industrial environments.

The Eltorque actuators are characterized by:

- Compact size and good torque to size/weight ratio.
- Flexible control interfaces for easy integration with a wide range of control systems.
- Low power consumption.
- Electronic configuration of speed, torque and other parameters.
- Easy and cost effective installation.
- Maintenance free.

The QT250 product is suitable for use on part-turn valves with an operating torque below 250 Nm, while the QT800 is suitable for 250-800 Nm.

Most part-turn valves utilize quarter-turn (90°) movement, but the QT250 and QT800 can easily be configured to an operation area within the range 0-359°. During the purchasing process, it is important to consider the following parameters.

1.1 Valve interface

It must be checked that the spindle and valve mounting holes either fit directly onto the actuator or alternatively consider spindle adapters and valve brackets.

1.2 Max operation torque

The actuator must have sufficient torque to operate the valve in all applicable conditions.

1.3 Closing time

This is usually determined as a part of the process development. In some cases, the closing time should be as short as possible if the valve for example is shutting down a system in case of failure. In other cases, a longer closing time is desired, to avoid shock waves in pipe systems with high pressure or flow.

The QT250 and QT800 have electronically configurable closing times.

1.4 Remote Control

The QT250 & 800 can be controlled remotely by CANopen (fieldbus, max 127 actuators per network).

For more details about the functionality of this control interface, see chapter “3.4 Eltorque interface boards”.

Additionally, the actuator can be configured and controlled from a computer using a dedicated cable and a software tool called Eltorque Manager 4.

1.5 EMC Location Class according to DNV

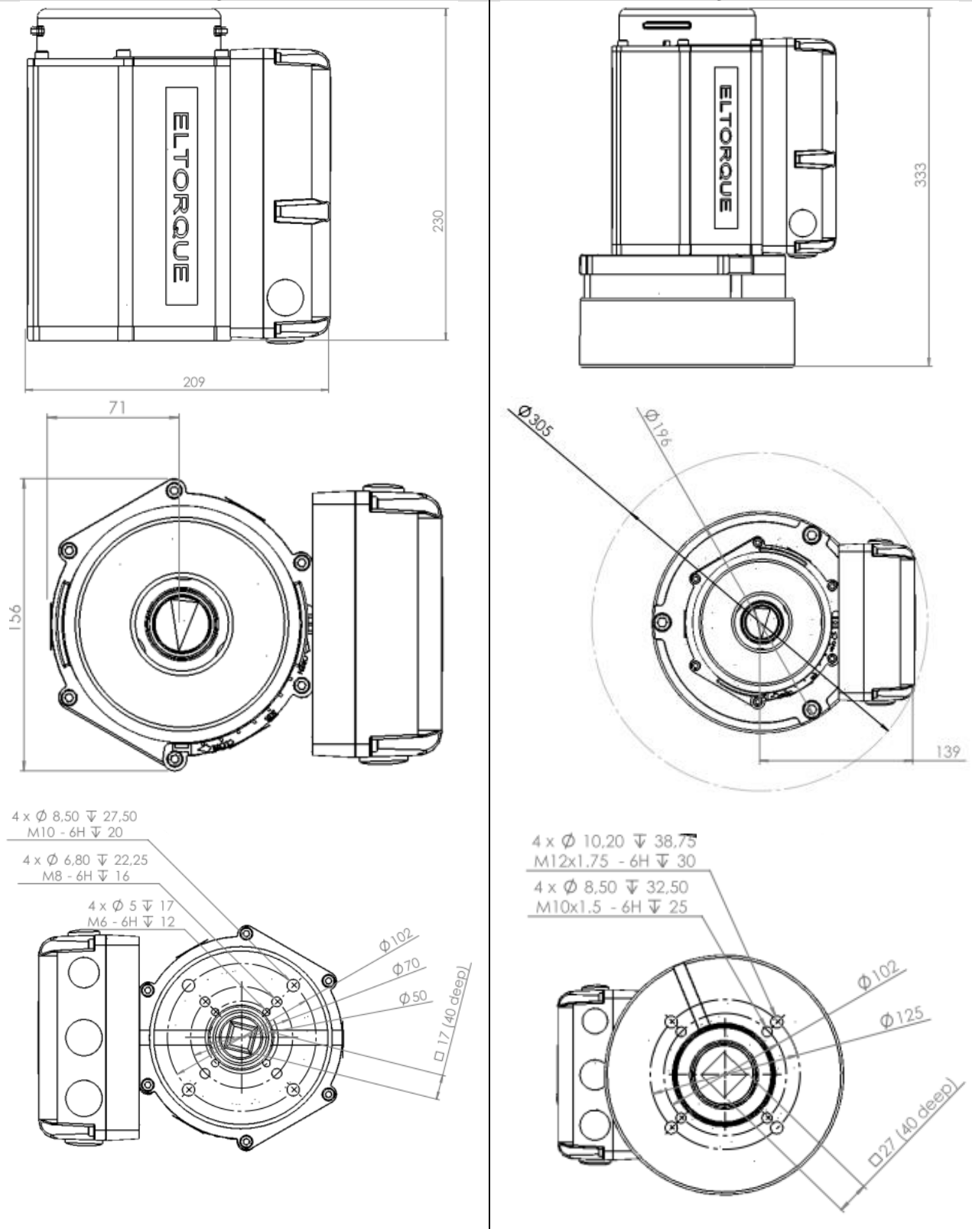
For EMC Location Class B there must, in addition to the actuator, be installed a PSF unit as a filter to obtain compliance to the Class requirements. This filter can be used with both versions 2.2 and 2.3 of the QT 250/800 Ex. For EMC location class A the version QT250/800 2.3 Ex must be chosen.

2 SPECIFICATIONS AND MANUAL OPERATION

2.1 Technical data

	QT250 2.2/2.3 EX	QT800 2.2/2.3 EX
Torque	50-250 Nm	160-800 Nm
Closing time	0-90° movement: 13 -60 sec	0-90° movement: 42 -180 sec
Dimensions (HxWxD)	229 x 156 x 209 mm	333 x 200 x 239 mm
Weight	12 kg	21 kg
Valve flanges (Ref. ISO5211)	F05, F07 & F10	F10 & F12
Standard valve adapter	SQ17	SQ27
Valve applications	Butterfly or ball valves with part-turn operation Butterfly valve examples: DN50-DN200 PN16	DN250-DN350 PN16
Operation temperature	-25 – 70 °C	-25 – 70 °C
Color	Silver	Silver
Encapsulation	IP68 (10m 72hrs) (IEC605229) IP65 (IEC 60079-0) Corrosion protected aluminium and steel enclosure	
Control interface	CANopen (Fieldbus)	
Position sensor	Range: 360° - 0,4° resolution Position feedback not corrupted by power failure	
Power supply	110 - 240 V AC ± 10%, 50/60 Hz, Max 130 W	
Power consumption	At 250/800 Nm load: <130 W Standby: <15W	
Over/ under temperature protection	Motor current is switched off in case of over-temperature	
Manual operation	Manual override without tools, max 4 Nm torque	
	21 turns on hand wheel = 90° movement on valve	74 turns on hand wheel = 90° movement on valve

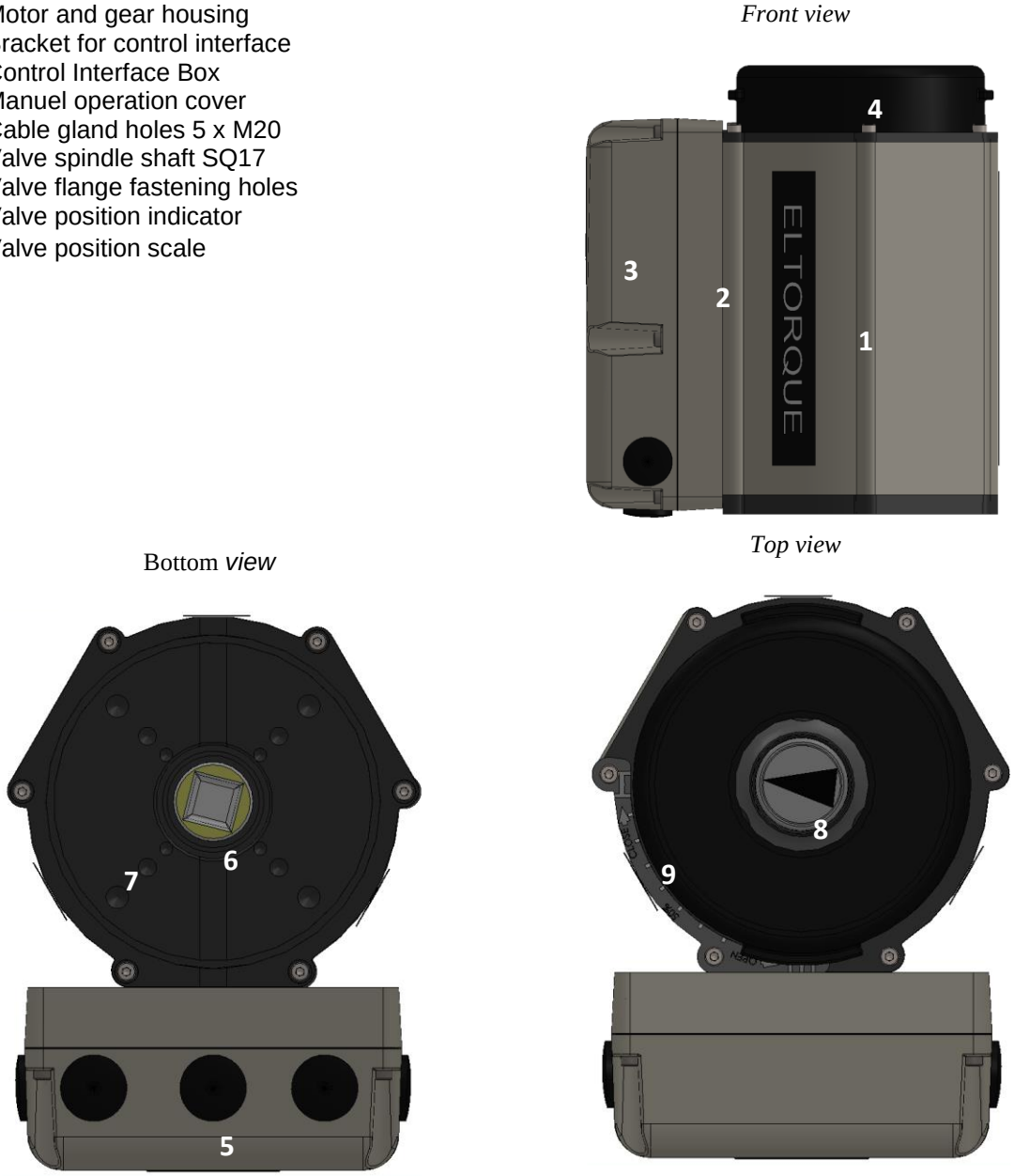
QT250	QT800



External, valve flange and spindle dimensions

2.2 QT250 2.2/2.3 EX External construction

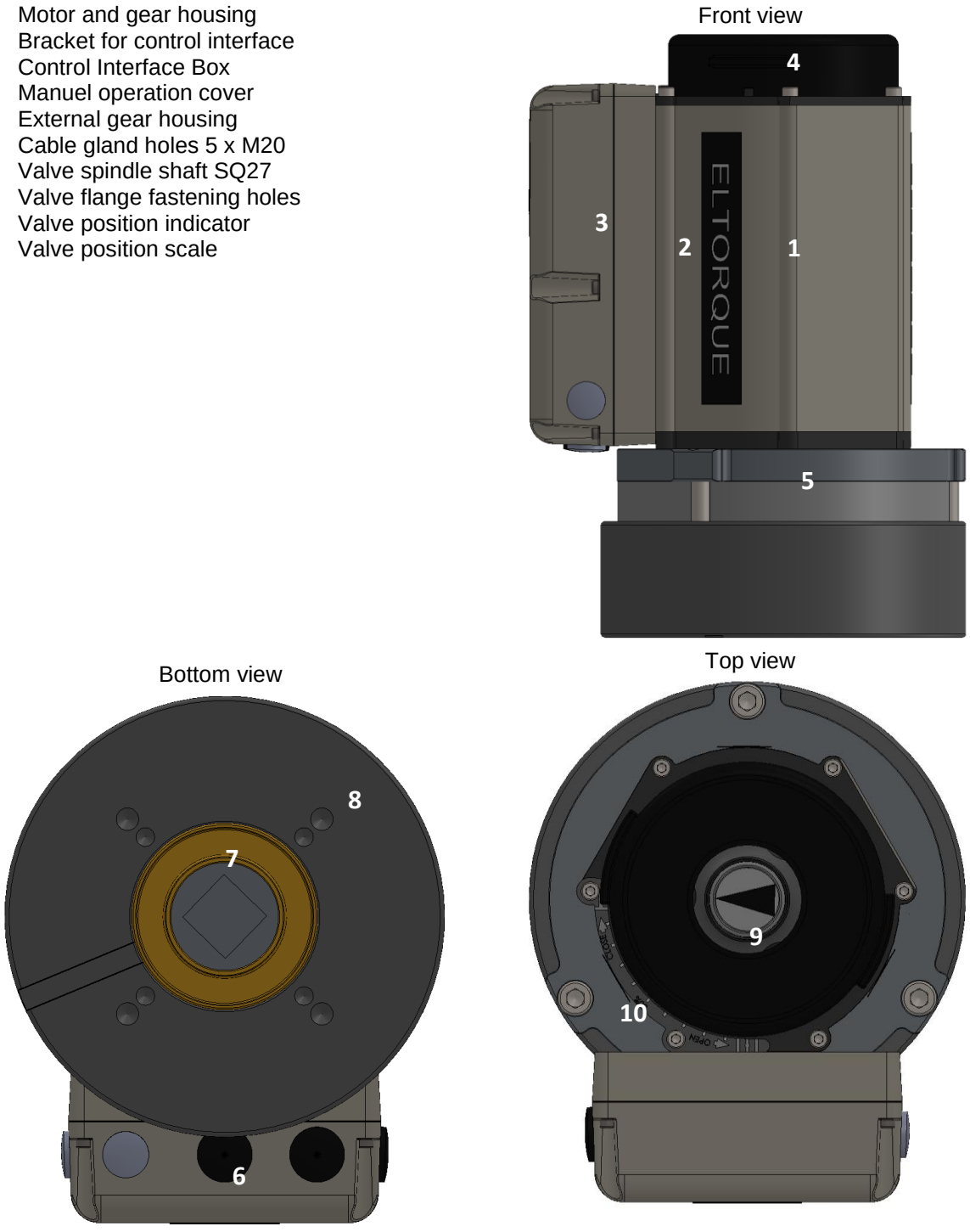
1. Motor and gear housing
2. Bracket for control interface
3. Control Interface Box
4. Manuel operation cover
5. Cable gland holes 5 x M20
6. Valve spindle shaft SQ17
7. Valve flange fastening holes
8. Valve position indicator
9. Valve position scale



QT250 External construction

2.3 QT800 2.2/2.3 EX External construction

10. Motor and gear housing
11. Bracket for control interface
12. Control Interface Box
13. Manuel operation cover
14. External gear housing
15. Cable gland holes 5 x M20
16. Valve spindle shaft SQ27
17. Valve flange fastening holes
18. Valve position indicator
19. Valve position scale



QT800 External construction

2.4 Operating conditions

The QT250 and QT800 are suitable for use below deck on ships and other offshore vessels due to its compact design, low power consumption and robust construction.
It can also be used in other applications as long as the following criteria's are met:

- Operating temperature is kept within specified limits.
- Actuator is placed indoors and not exposed to direct sunlight.
- Protected from extensive corrosive atmospheres like on open deck of ships or other areas exposed to salt water spray. Cleaning or pollution with strong alkaline or acidic chemicals can also cause corrosion problems.

2.5 Actuator duty cycle

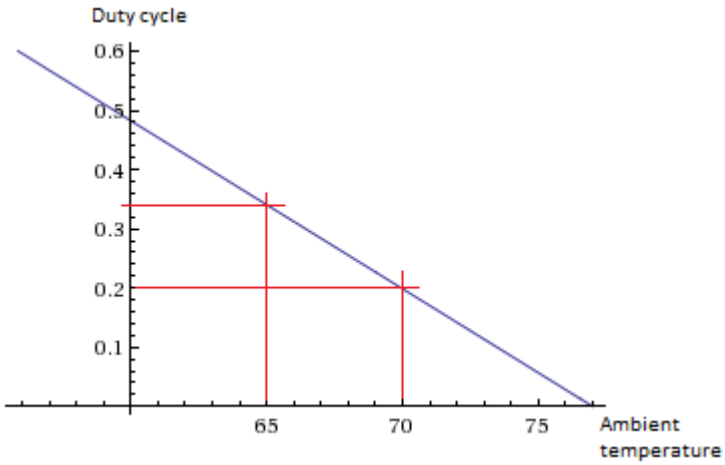
When electric valve actuators operate, they generate internal heat due to thermal loss in motor and –control electronics. The QT250 and QT800 combines low power consumption with high efficiency to ensure that internal thermal loss is kept low.

Still, duty cycle needs to be considered when designing the valve control system to ensure that the actuators can operate the valves without over-heating.

In case the actuator's internal temperature becomes too high, the actuator will shut down the motor until temperature decreases to a safe level. This functionality is implemented in the firmware of the actuator. If the firmware fails for some reason, internal fuses in hardware will trigger to prevent overheating of the actuator or too high currents in the electronics. These fuses are not resettable.

To avoid problems with over-temperature alarms and actuator shutting down, duty cycle requirements should be considered before selecting actuator.

The maximum possible duty cycle due to firmware restrictions, as a function of ambient temperature is:



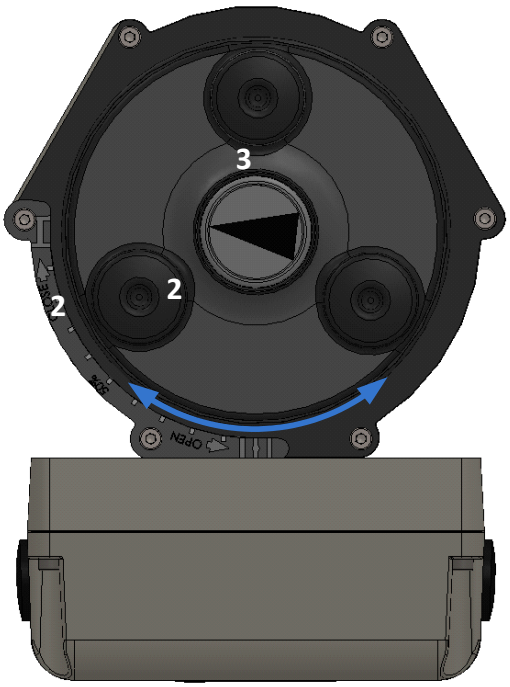
For instance, if the ambient temperature has reached 65 degrees, the duty cycle will, after some continuous operation, approach 34%. If the ambient temperature has reached 70 degrees, the duty cycle will approach 20%.

2.6 Manual operation

In case of power failure, control system error or another fault preventing normal operation of the actuator, it can be operated manually without the need of additional tools:

1 Remove hand-wheel cover by grabbing the tabs and pulling it straight up.
2 Turn hand-wheel Clockwise to close or Counter-clockwise to open valve.
3 Valve position can be seen on the visual indicator in the centre of the hand-wheel and reference is made to the scale (D).
4 When Manual Operation is completed, refit hand wheel cover by pressing it down until it stops against the actuator's top cover.

Removing hand-wheel cover



Manual operation features

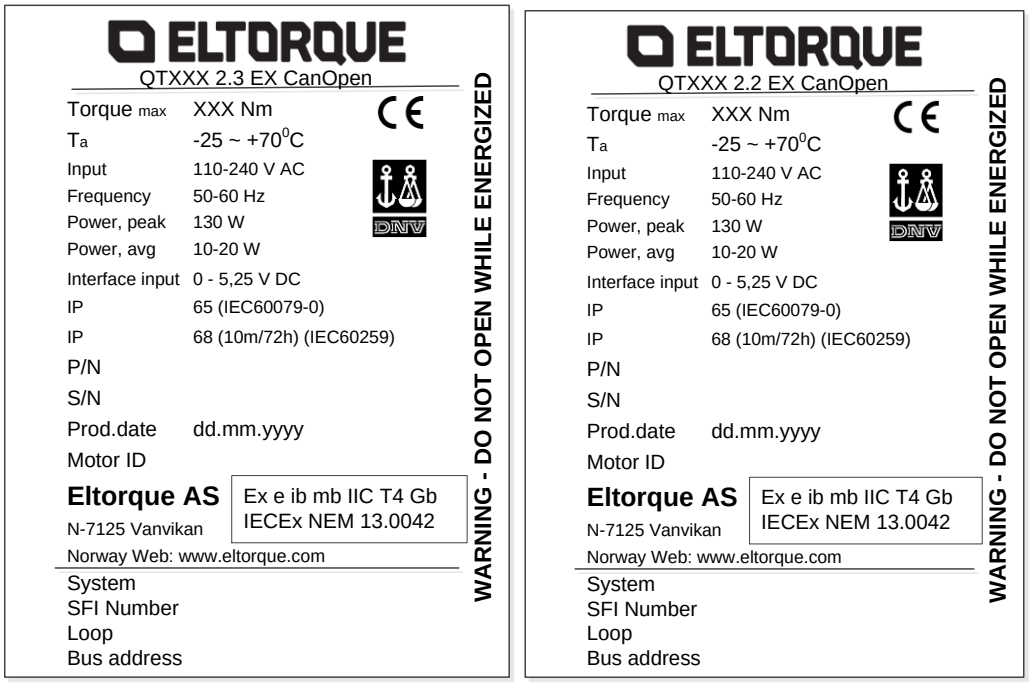
3 INSTALLATION

3.1 Safety instruction

The product is marked with the following warning:

"Warning – Do not separate while energized"

All personnel working with equipment and installation in a hazardous area must have proper training, and shall therefore understand the EX-related marking on the label. Under is an example of the label for Eltorque products QT250 2.2 Ex and QT800 2.2 Ex.



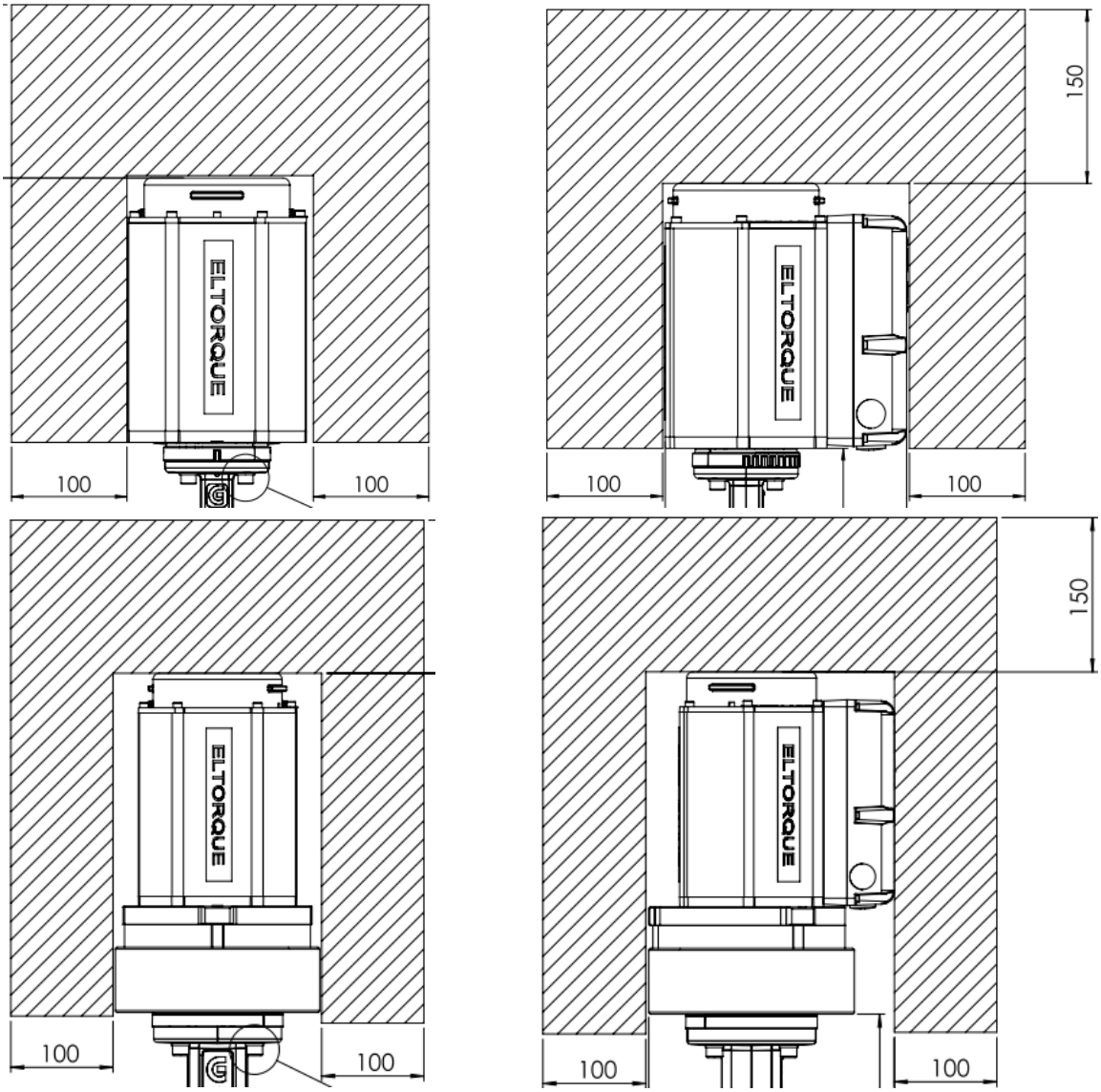
Example of marking label for Eltorque QT 250 & QT800 EX products

Comments:

- T_a denotes the interval of the ambient temperature (maximum and minimum temperature) for the environment the equipment can be used. For this equipment T_a= -25 °C to +70 °C.
- IIC, the gas group, means that the equipment is certified for use in hazardous areas with gases in group IIC (ignition energy>20 µJ). The equipment can also be used with gas group IIA and IIB, which has higher limits of ignition energy.
- T4 denotes the temperature class. T4 has a maximum surface temperature of 135 °C in the T_a given.

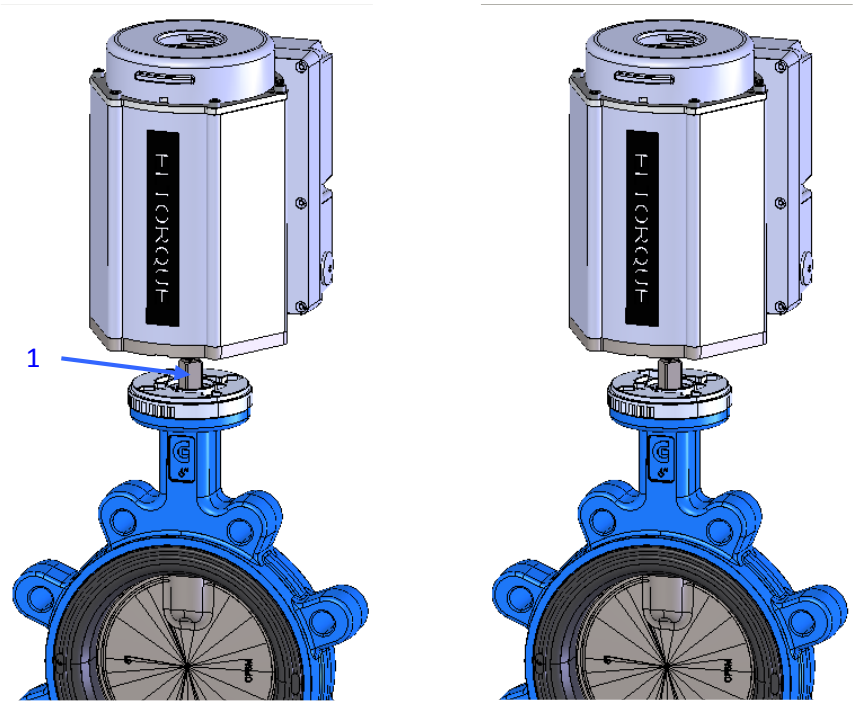
3.2 Mounting actuator on valve

Before mounting actuator, please make sure there is sufficient space for installation, service and manual operation above and around it:



Space for installation, service and manual operation

1. Apply grease on valve spindle to ease mounting and avoid corrosion.
2. Lift actuator onto valve; align its valve adapter with the valve spindle and lower actuator onto valve flange.
   Note: Keep hands away from the valve flanges to avoid crushing damages.
3. Use hand wheel to turn actuator and align fastening holes of the valve flanges.
   Note: In order to achieve optimal functionality of valve position indicator, actuator should be positioned as shown in Figure 3 below.
4. Insert fastening screws and use washers according to ISO5211 standard and valve vendor's specifications.
5. Tighten fastening screws to the specified torque.



Lowering actuator onto valve *Correct orientation of actuator*

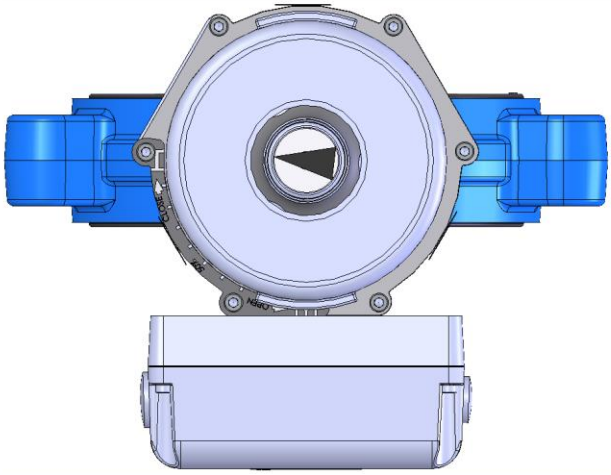


Figure 3: Aligning fastening holes and inserting screws

3.3 Electrical connections

Eltorque Ex actuator is delivered with transport plugs covering the connection holes in the electronic and interface box. These transportation plugs must be removed and replaced with EX approved glands according to the appropriate Ex protection class.

3.3.1 Power supply: 230V AC 50/60 HZ

Cable glands: Use suitable and approved EX cable glands. Follow instructions given by manufacturer. When choosing cable glands, account for a temperature rise ΔT = 20 ˚C under normal operation. For actuators that will be used in an ambient temperature of 70 ˚C, the cable glands must be specified for operational temperature of at least 70 + 20 = 90 ˚C

Cable: 2x1.5mm^2 + GND (max 2.5mm^2).

It is possible to connect more than one actuator to the same circuit. Recommended fuse size is 2x10A, 13A, 16A.

At maximum torque, 250Nm, maximum power consumption is 130W. At max holding torque, 175 Nm, maximum power consumption is 70W.

Motor starting current is approx. 5 times normal operating condition after loss of power supply (use time-lag fuses, C-characteristics).

IMPORTANT: DO NOT SEPARATE WHEN ENERGIZED!

3.3.2 Control facilities

- Cable glands: Use suitable and approved EX cable glands. Follow instructions given by manufacturer.
- Cable: Recommended core dimension is 0.75mm^2 (maximum 1.5mm^2) UNITRONIC BUS CAN or similar.
- Number of conductors: See section 0 Eltorque interface board.
- *General:* Push buttons, PLC or similar types of process-control systems can be used for controlling ELTORQUE™ **QT250.**
- *Outputs and inputs:* See section 0 Eltorque interface board.

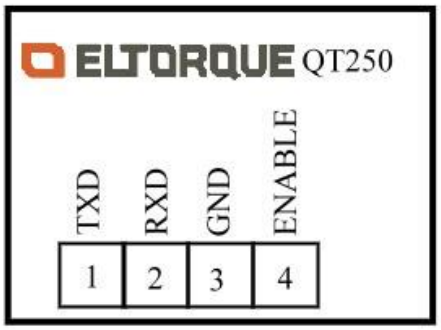
3.3.3 EX

Certification number: IECEx NEM 13.0042

Ex e ib mb IIC T4 Gb

Area classification: Zone 1 – Areas where and explosive atmosphere occurs occasionally under normal operation conditions. Max surface temperature is 135°C. Installation and preparation must be done according to requirement in Ex-directive, also compliance with directive EN-60079-14.

3.3.4 Programming



Terminal connection RS232 (X2)

Pre-programming by supplier: Other values than the pre-programmed ones, can be ordered when the actuator is ordered.

Programming by user: Re-programming can also be performed by user.

This is done by special software and a special cable, which can be ordered separately.

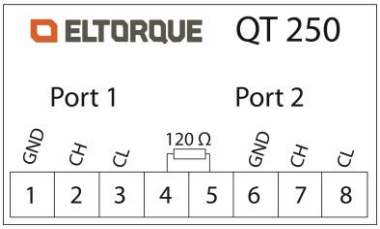
Programming can also be performed by bus interface.
See section **3.4 Eltorque interface boards.**

3.3.5 Assembly

EX CANopen interface can only be assembled with QT250 2.2/2.3 EX or QT800 2.2/2.3 EX.

3.4 Eltorque interface board

Connections of ELTORQUE™ Interface: 2.2/2.3 EX CANopen



Terminal connections: Max 1.5 mm^2

Incoming cable (port 1)
1: Signal ground CANopen
2: CAN_H
3: CAN_L
4: Termination end resistor
5: Termination end resistor

Outgoing cable (port 2)
6: Signal ground CANopen
7: CAN_H
8: CAN_L

Serial communication (CANopen) demands a twisted pair cable (UNITRONIC BUS CAN or similar). In use of shielded cable, EMC glands are required. The transmission range increases with lower capacitance and larger diameter in a cable. The cable should have a transmission resistance less than 70mΩ/m especially on bus line longer than 40 meters. Recommended maximum cable length is 250m at baud rate 125 kbit/s and cable cross section 0.75 mm^2. Maximum number of nodes (actuators) is 50 units per serial line (LOOP).

Interface board **2.2/2.3 EX CANopen** should be connected to terminals CAN_H, CAN_L and signal ground for incoming/outgoing cable (port 1/port 2). CANopen is designed for multidrop network applications. When a system is installed it should form a bus structure, star shaped networks should never be created. CANopen network with maximum 50 actuators, each of them should have a unique address. **The address is set in software.**

It is recommended to have a termination (jumper between terminal 4 and 5) on the actuator at the end of the network.

Programming of speed, operating torque, holding torque, and opening grades, is done with a special configuration program via CANopen, or via a supervisory screen system which must be adapted to the CANopen protocol. Programming of speed, operating torque, holding torque, opening grades, torque limit switch is done with a special configuration program via RS232 on terminal 1, 2 and 3 on X2.

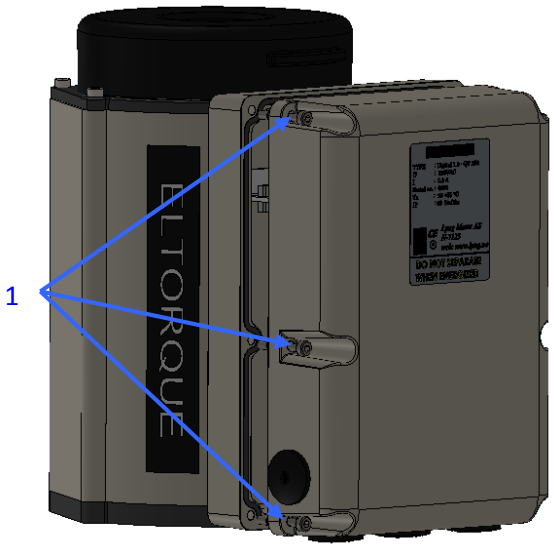
For further information, please contact Eltorque AS.

3.5 Electrical installation

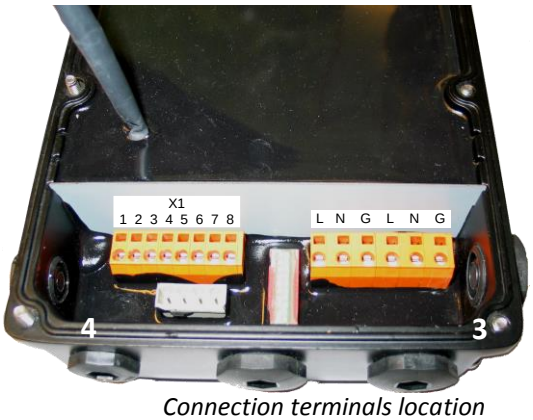
Note: Electrical installation can only be designed and made by personnel with the appropriate skills and competence. Ensure all such work is done according to applicable laws and regulations.

1. Loosen control interface fastening crews, 6 pcs.
2. Remove control interface box by pulling it straight out.
3. Make sure fuses are disconnected before connection of powersupply cables is started.
4. Install the power supply cables through the cable glands on the right side and connect them to the L, N and G/ PE terminals.

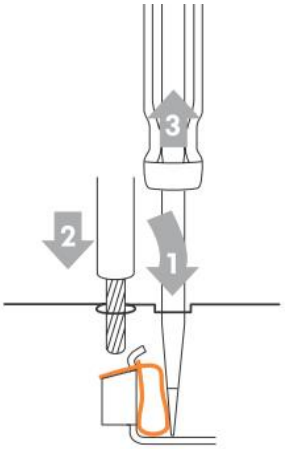
Install the control signal cables through the cable glands on the left and connect them according to X1 according to specification below.

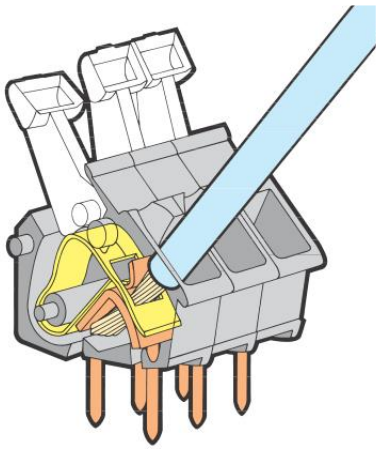


Removing control interface box

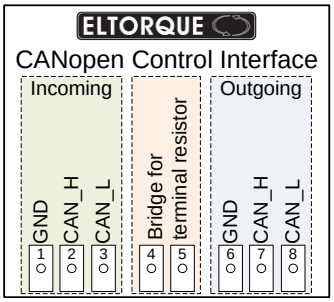


Connection terminals location





Operation of spring loaded terminals



Control signal connection terminal

Control Interface functionality, cable recommendations etc. are described in the “3.4 Eltorque interface boards”.

3.6 Configuration of actuator

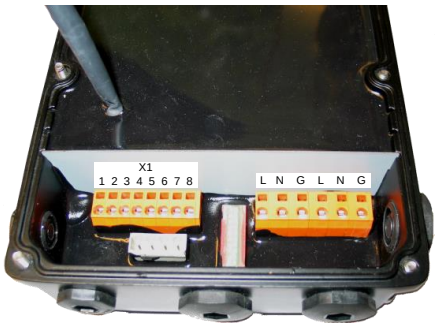
The QT250 and 800 actuators are configured electronically using the Eltorque Manager 4 software and a USB configuration cable. Manager 4 is distributed by e-mail or can be downloaded from our website, while the configuration cable can be purchased from local Eltorque distributor or the head office in Norway (see contact information at the start of the manual).

The following parameters can be configured:

- End positions – Closed and Open.
- Speed, Torque and Near Closed region.
- Fieldbus address/node ID for CANopen.

End positions and fieldbus address are mandatory, while the other parameters can be changed to achieve better valve control performance.

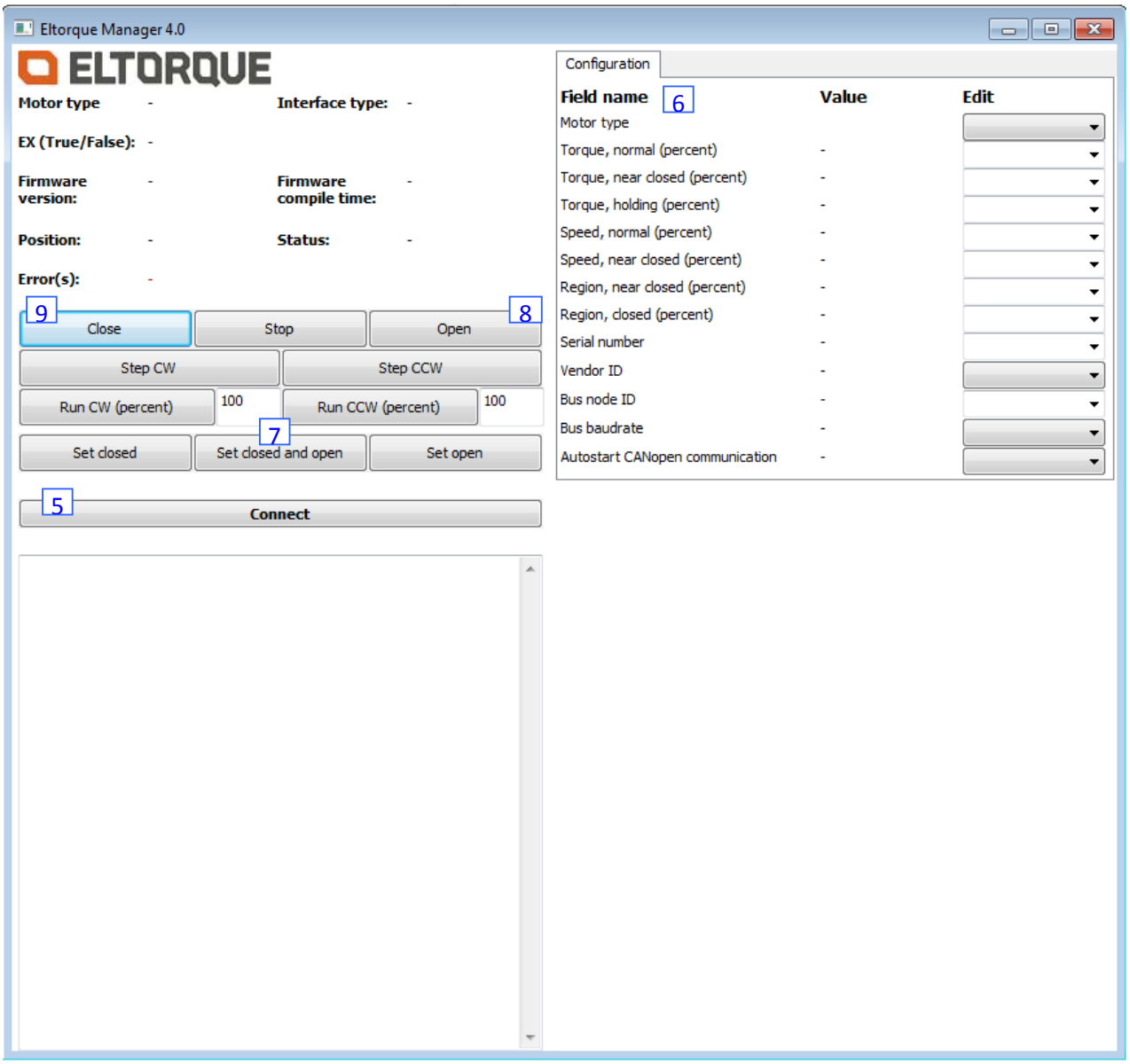
Eltorque Manager 4 installation files



Connection of configuration cable

1. Install Eltorque Manager 4 and if required driver for configuration cable on your computer.
2. Connect configuration cable to a USB port on your computer.
3. Start Manager 4
4. Connect cable to actuator's configuration connector.
5. Press **Connect** to establish communication with the actuator.
6. Select appropriate configuration values depending on valve and control system, see section 3.7 for more information.
7. Use Hand-Wheel to move valve to closed position, see section 2.6 for details.
   Press Set C&O and Closed is set to the actual position, while Open is set 90° away in counter clockwise direction. If further adjustment of end positions is required, move actuator to desired position and press Set Closed or Set Open.
8. Press Open to open valve and check that actuator operates correctly.
9. Press Close to close valve again.
10. Disconnect configuration cable and refit control interface.

Note: Make sure actuator is powered before attempting to connect actuator with Eltorque Manager 4



Eltorque Manager 4 screenshot

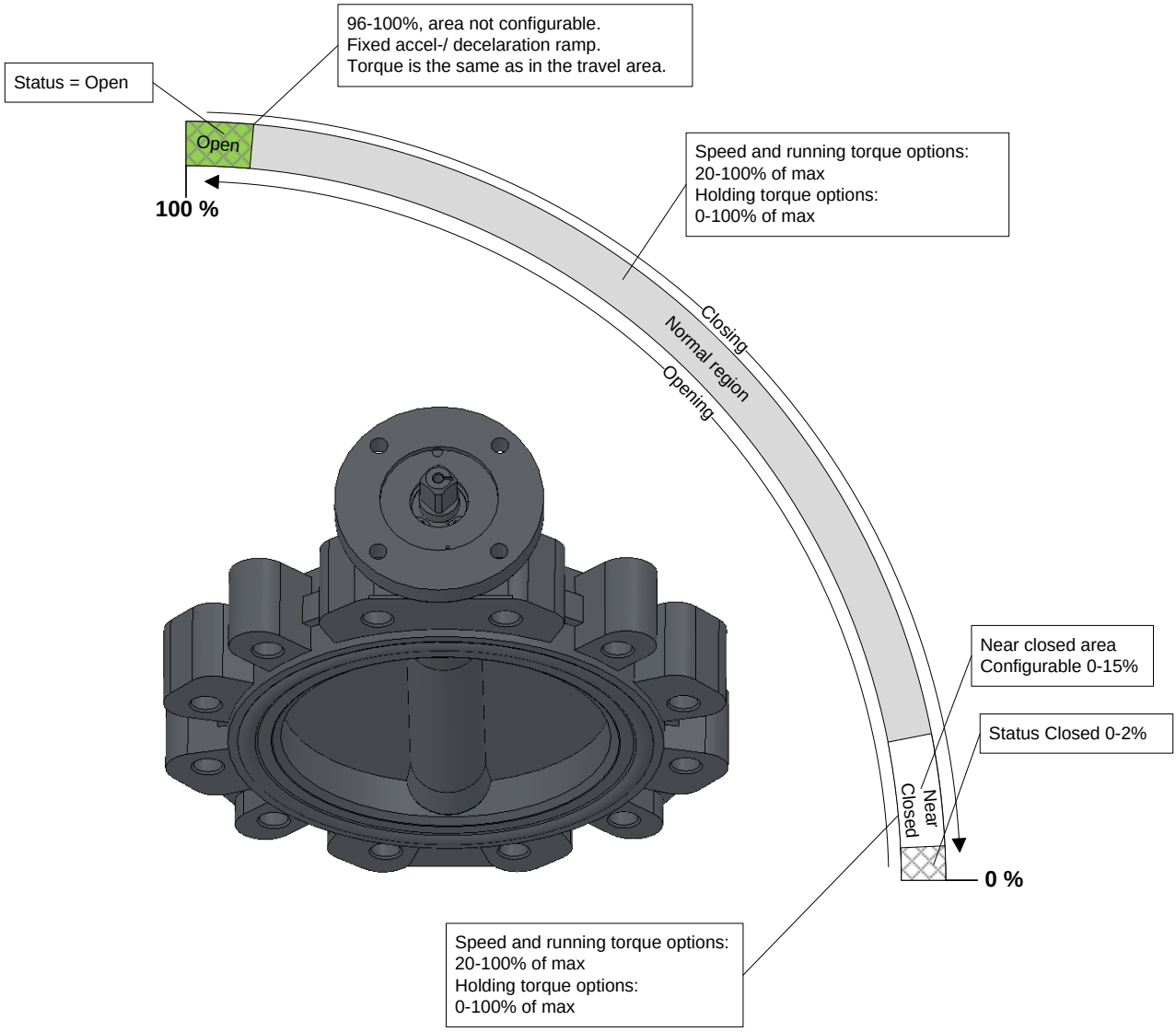
3.7 Selecting correct configuration

The QT250 and QT800 offer an easy but advanced configuration set-up, which allows accurate adjustments depending on valve and control system characteristics.

Please consider the following items when selecting configuration values:

- Set torque values according to valve's torque specifications with a suitable safety margin. If torque is set too high, the valve might be damaged in case it is blocked by e.g. foreign objects inside pipe.

- On butterfly valves, the maximum torque is required to move disc in and out of the gasket in closed position.
  Hence should only the torque in the near closed region be set according to the valve's specified operation torque. Torque in the travel area will be considerably lower.
- Ball valves tend to have a constant torque through the whole operation area, but the maximum torque is reached when the valve movement starts, so called "breakaway" torque.



Torque, speed and region settings

- Under Fieldbus settings you can set the Node ID of actuators with CANopen Control Interface. It is important that all actuators in the network have a unique Node ID and that it is set correctly according to the layout of the control system.

Refer to chapter "3.4 Eltorque interface boards" for more information.

4 MAINTENANCE, SERVICE AND TROUBLESHOOTING

4.1 Maintenance

The QT250 & 800 is in principle maintenance free; all bearings and gears are lifetime lubricated and components are designed to last throughout the actuator's lifetime. It is however recommended that the actuator is inspected regularly to reveal any damages caused by mechanical impact, corrosion etc. Top cover gasket and manual operation shaft seal should be lubricated with suitable lubricants if they appear to be dry.

4.2 Spare parts

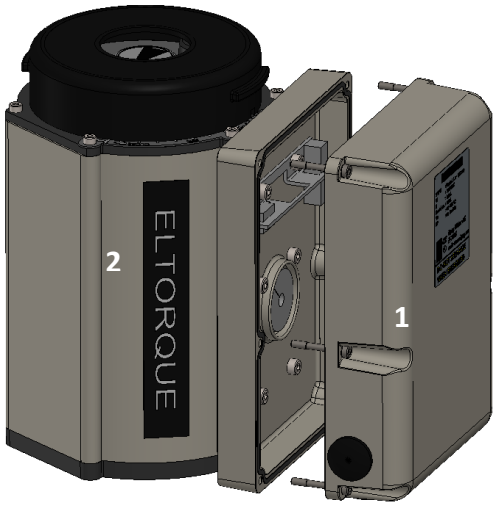
1. Control Interface:

Part No.	Description
EX250.025.3	QT250 2.3 EX CANopen Interface
EX800.025.3	QT800 2.3 EX CANopen Interface

2. Actuator:

Part No.	Description
EX250.002.2	QT250 2.2 EX Actuator
EX800.002.2	QT800 2.2 EX Actuator

Note: If control interface is replaced, it must be re-configured using Manager 4 as described in section 3.6.



Control interface

4.3 Troubleshooting

Problem description	Cause & solution
No response from actuator either on the control system or if you connect with Manager 4. No change in resistance on the hand wheel if you cycle the power supply.	No power supply, check fuses and wiring. Supply voltage can be checked using a voltage meter. L-N voltage should be 230 V AC ± 20%.
Actuator's alarm output is active, on a fieldbus system it gives torque alarm. The actuator attempts to move valve when a control signal is given.	Valve operation torque is too high, please check torque by manual operation. Be aware that foreign objects in the pipe can block the valve and that valve torque changes over time. **OR** Actuator torque has been set too low, increase it by using Eltorque Manager 4 as described in section 3.6. On fieldbus control systems, torque can be adjusted via the fieldbus communication.
Actuator is able to operate the valve but the operation time is longer or shorter than desired.	Change actuator's speed by using Eltorque Manager 4 as described in section 3.6. On fieldbus control systems, speed can be adjusted via the fieldbus communication.
Actuator's alarm output is active, on a fieldbus system it gives temperature alarm. The actuator responds normally to control signals.	Actuator's internal temperature is 10°C or less from the motor current shut-down limit. If possible, allow actuator to cool down by leaving it in standby mode for 15 minutes or more.
Actuator's alarm output is active, on a fieldbus system it gives temperature alarm. The actuator does not respond to control signals.	Actuator has over-heated and the motor current is shut down to prevent damage. Make sure surrounding temperature is within limits and that the duty type requirements are followed. See section 2 for more details.
Indicator LED is "normal". The actuator does not respond to control signals. On a fieldbus system, the actuator is not available.	Faulty control system, please ask system vendor for support. **OR** Problem with control signal wiring, please contact local Eltorque agent for support.

Problem description	Cause & solution
Actuator with fieldbus interface does not respond to control signals. The actuator responds normally when tested with Manager 4.	Incorrect fieldbus settings, please check configuration with Manager 4. **OR** Fieldbus control system is not wired or configured correctly.
Actuator with digital or analog interface does not respond normally to control signals. The actuator responds normally when tested with Manager 4.	Incorrect digital or analog inversion settings, please check configuration with Manager 4. **OR** Digital or analog control system is not wired or configured correctly.
Actuator does not respond neither to control signals nor when tested with Manager 4. Actuator power supply is verified with voltage meter.	Defective control interface, must be replaced.
After replacement of interface, actuator does not operate correctly.	Interface has not been configured correctly, please refer to section 3.6. Contact local Eltorque agent for support if required.

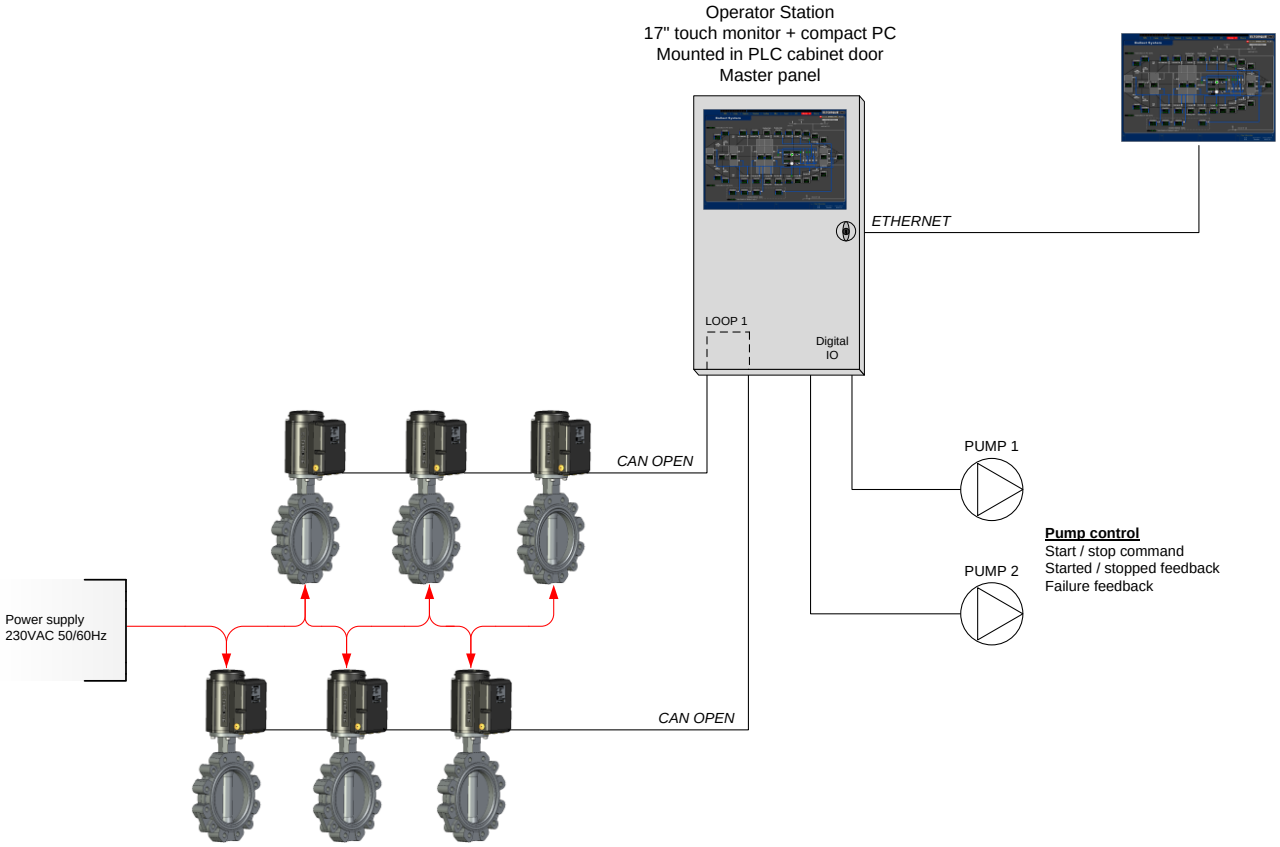
5 APPENDIX

5.1 Terminology

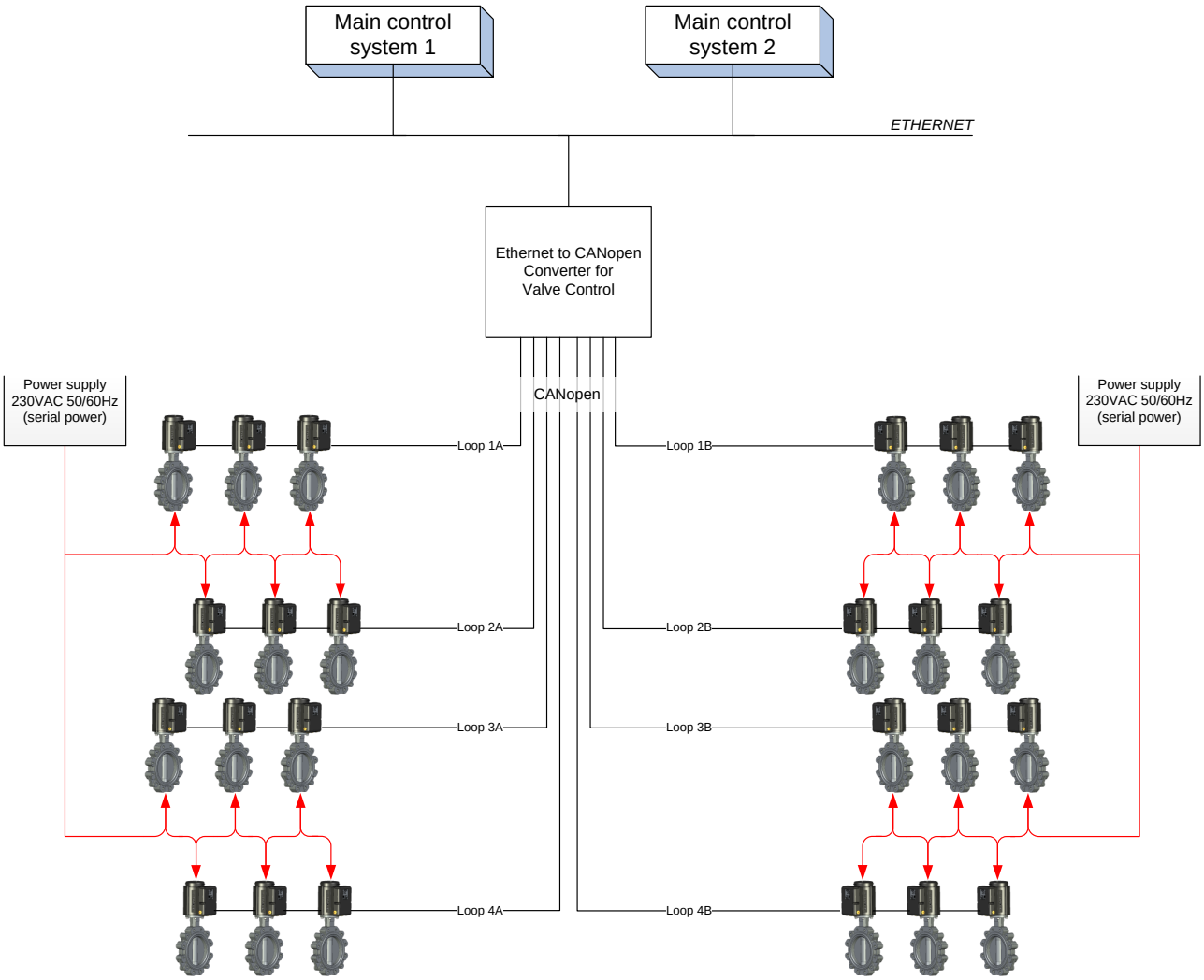
Term	Description
Valve	A valve is a device that regulates the flow of materials (gases, fluidized solids, slurries, or liquids) by opening, closing, or partially obstructing various passageways. This manual mostly refers to quarter-turn valves with a 90 degrees movement between Closed and Open position.
Valve actuator	An electric device for operation of valves in various process control systems.
Valve flange	The surface of the valve which the actuator is fastened to. Most commonly it is holes for 4 screws, where hole size and distance between them is defined in EN ISO 5211 standard.
Valve adapter	A device used to connect the actuator to the valve spindle/ stem.
Control Interface	Electronic device controlling the valve actuator according to signals from an overall control system. e.g. PLC or other type of electronic controller.
Configuration	The set-up of parameters, which affects the actuator's performance and behaviour.
Hazardous area	Area in which the permanent or periodical presence of explosive substances causes a risk of explosion.
PLC	A Programmable Logic Controller is a digital computer used for automation of industrial processes, such as control of machinery on factory assembly lines, measurement and control of process plants etc.
Digital Control	Simple control utilizing relays, on/ off switches and indicators. Allows only Open or Closed functionality for a valve actuator.
Analogue Control	Step-less control utilizing analogue current or voltage signals, e.g. 4-20 mA, 0-10 V etc. Allows positioning of the valve actuator between Open and Closed.
Fieldbus Control	A fieldbus is an industrial computer network for real-time distributed control of various devices, including valve actuators. When Eltorque valve actuators are controlled by Fieldbus, the functionality is extended in terms of positioning, commands, feedback and configuration.

Term	Description
Modbus	The Eltorque Modbus interface is using RS-485 serial communication utilizing the Modbus protocol. Modbus is a fieldbus which allows communication with max 31 actuators connected to the same “master-slave” network. “Master-slave” means that the Modbus controller is a master which actively sends commands and requests to the “slave actuators”.
CANopen	The Eltorque CANopen interface is using the CAN (Controller Area Network) communications standard. CANopen is a fieldbus which allows communication between max 127 actuators connected to the same network. It is not a “master-slave” network (ref. Modbus), hence all nodes in the network can actively send messages at their own initiative. The communication is prioritized, meaning that urgent messages are transmitted and received before information with lower priority. Compared to Modbus, CANopen has the following advantages: • More reliable communication, i.e. it is more likely that the information transmitted is received correctly by the recipient. • More nodes per network, max 127. • More control and configuration features available.

5.2 Control system examples



Stand-alone valve and pump control with operator stations.



Valve control system as an integrated part of a larger control system.

6 DOCUMENT HISTORY

EX150.0001 User Manual QT250/800 2.2/2.3 EX CanBus

[ ] Schedule drawing

[X] Related drawing to schedule drawing # EX150.0002 Safety Manual QT250 QT800 2.2/2.3 Ex

Document regarding

[ ] QA
[X] QT 250 2.2 Ex
[X] QT 800 2.2 Ex
[X] QT 250 2.3 Ex
[X] QT 800 2.3 Ex
[ ] PSF
[ ] General documentation
[ ] QT 250 Exde
[ ] QT 800 Exde
[X] CanOpen
[ ] Digital
[ ]

Document history

Version	Change description	Changed by	Change date	Approved by	Approval date
0	Document established	SH	29.07.2013		
1	Precision on Ex cable glands	BN	21.10.2013	TMM	21.10.2013
2	More on cable glands, updated duty information, changed Manager 2 to Manager 4, added header, updated name plate,removed digital	ERB	26.11.2013	BN	27.11.2013
3	Included revision 2.3 of the product	BN	18.08.2014	TMM	18.08.2014

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